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Developing Meaningful Carbon Offsets for Bates College

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Developing Meaningful Carbon Offsets for Bates College

Horace Henriques, Nicholas Ford, and Felix Xie
Community Engagement Research in Environmental Studies (ENVR 417)
Bates College, Fall Semester 2014

Executive Summary

This project was conducted, as a template, to make Bates College a more sustainable energy community. By recommending renewable energy certificates (RECs) and carbon offsets that are meaningful to the Bates Committee on Environmental Responsibility we have provided a roadmap for the college to obtain its ultimate goal of carbon neutrality. The aim of this project was to provide a general overview of the REC and carbon offset market for our community project partner Julie Rosenbach, the Manager of Sustainability Initiatives at Bates College. We are offering five recommendations of RECs and carbon offsets that are meaningful investments for Bates College and its community.

RECs are defined as carbon offset that "represent the environmental and other non-power attributes of renewable electricity generation and are a component of all renewable electricity products" (EPA 2014). A single Class I REC represents 1000 kilowatt-hours of electricity that is generated from a renewable energy source (e.g. wind, hydroelectric, solar, or biomass) (EPA 2014). Purchased RECs represent that the owner is using electric power generated from a carbon-free source. RECs have been available for decades, but recently have gained more traction as a practical way to obtaining carbon neutrality as clearer definitions and measures have been put in place (Main 2007). Similarly, carbon offsets, "a unit of carbon dioxide-equivalent (CO_2e) that is reduced, avoided, or sequestered to compensate for emissions occurring elsewhere," provide an alternative way to reduce a carbon footprint (Goodward & Kelly, 2010).

Bates College, after signing the American College and University Presidents' Climate Commitment or ACUPCC, has elected to pursue climate neutrality thus entering the voluntary carbon offset market. Our five recommendations are based on our findings within the market and how we defined an offset program as meaningful. Developing a definition and criteria for meaningful RECs and carbon offsets was crucial in the process of selecting our recommended programs for Bates College to invest in. We considered many factors surrounding the idea of a sustainable community and how to create a positive impact on the environment of and around Bates College through investing in locally meaningful offset programs.

Our definition of meaningful entails four major categories: Locality, Additionality, Cost-effectiveness, and an Educational component. Locality refers to the permanence, closed-looped nature, and potential economic benefits of an offset. These three sub-categories are all necessary for a program to have an aspect of "additionality". Additionality is a unique part of the definition of a carbon offset, and references the idea that further invested monies from the consumer, beyond the price of electric power, is necessary for the continuation of the program either through maintenance costs, continued growth of infrastructure, or further innovation. Cost effectiveness is the theoretical and future net gain of investing in an offset program. Finally, we want our recommendation to have an education component or have educational potential for the Bates College community.

Our final recommendations were determined through the use of our defined criteria of a meaningful carbon offset program. The programs contained in this report will provide Bates College with a variety of options on how to achieve climate neutrality in a meaningful and sustainable way.

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Acronyms:
ACUPCC - American College and University Presidents' Climate Commitment
CAP - Climate Action Plan
CDM - Clean Development Mechanism
CO_2e - Carbon Dioxide Equivalent
CORE - Carbon Offset Research & Education
REC - Renewable Energy Certificate
EAE - Exeter Agri-Energy
EIA - Energy Information Administration
EPA - Environmental Protection Agency
GHG - Greenhouse Gas
LEED - Leadership in Energy and Environmental Design
MTCDE - Metric Tonnes of Carbon Dioxide Equivalent
NEPOOL - New England Power Pool
NGO - Non-Governmental Organization
UNFCCC - The United Nations Framework Convention on Climate Change
VCO - Voluntary Carbon Offset
VER - Verified Emission Reductions

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Table 1

A breakdown of emissions at Bates College and their sources over the last five years (2009-2013) (Bates Climate Action Plan 2014).

	2009[2]	2010	2011	2012	2013
	metric tons	metric tons	metric tons	metric tons	metric tons
Scope 1					
On-Campus Stationary	7,337	6,374	6,999	6,198	6,534
Direct Transportation	284	245	232	203	285
Refrigerants & chemicals	257	82	134	70	25
Agriculture	8	6	6	6	6
SCOPE 1 TOTAL	7,886	6,707	7,371	6,447	6,850
Scope 2					
Purchased electricity	4,635	4,859	4,770	4,845	4,807
SCOPE 2 TOTAL	4,635	4,859	4,770	4,845	4,807
Scope 3					
Faculty/staff commuting	1,285	1,300	1,311	1,583	1,533
Electricity transmission loss	458	480	472	479	476
SCOPE 3 TOTAL	1,743	1,780	1,783	2,062	2,009
TOTAL GHG EMISSIONS	**14,264**	**13,346**	**13,924**	**13,384**	**13,666**

Table 2

This table depicts the necessary cost and effect the installation of the biomass boiler and cogeneration turbine would have on Bates College. The number with the asterix is the amount (in MTCDE) of carbon that would need to be offset in order to obtain climate neutrality (Bates Climate Action Plan 2014).

Strategies	**Cost**	**MMBTUS Reduced**	**MTCDE Reduced**	**Impact on annual Energy Budget**
Convert the central heating plant to biomass boiler and install a cogeneration turbine.	$10,000,000	89,281	4,966*	↓

* This would increase our total reduction of greenhouse gases on campus to 75%, and reduce our purchase of RECs and offsets to 3,415 MTCDE.

Table 3

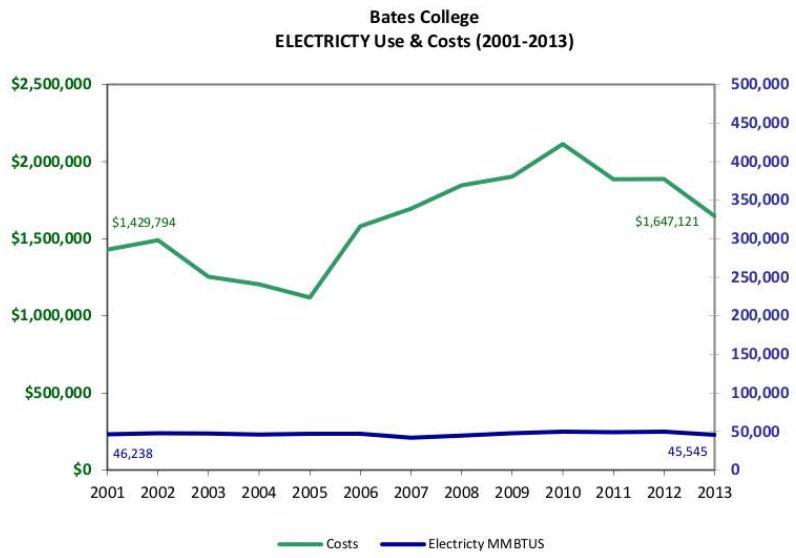
This table depicts our five recommendations to Bates and how they are meaningful according to our criteria. A green check mark indicates that the recommendation satisfies that particular aspect of our criteria. A yellow dash indicate that the recommendation partially satisfies it. A red X indicates that the recommendation does not satisfy it. Bates' current REC is included at the bottom of the recommendation list for reference.

	Locality	Permanence	Closed-Loop	Secondary Economic Benefits	Cost Effective	Educational	Additionality
Exeter Agri-Energy	✔	✔	✔	✔	–	✗	✔
Maine Tidal	–	✔	–	–	✗	✗	✔
Maine Green Power Program	–	✔	–	–	✔	–	✔
Community Carbon Fund	✔	✔	✔	✔	–	✔	✔
NEPOOL	✗	✔	–	✗	✔	✗	✗
NewWind (Current)	✗	✔	✗	✗	✔	✗	✗

List of Figures

Figure 1

These two graphs show Bates College electricity and Oil/Natural gas usage and their respective costs. Investing in RECs will cause the price of electricity to increase, but after the installation of the biomass boiler and cogeneration turbine, the costs for oil and natural gas should be minimal (Bates Climate Action Plan 2014).



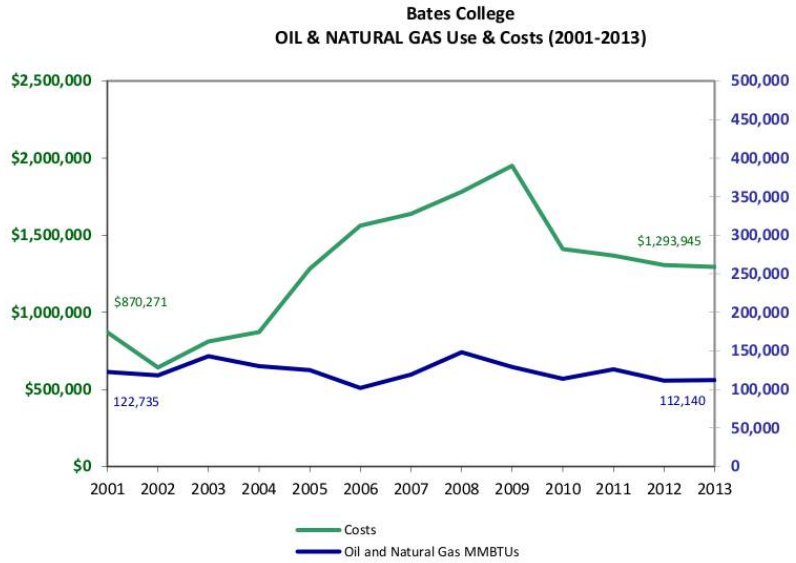


Figure 2

This figure shows MTCDE/student capita at all of the NESCAC schools, excluding Tufts University due to it being vastly larger in student population and the presence of graduate students. The amount of MTCDE is ignoring all offsets, and some of the data may be outdated, but it shows which schools are making strides and which are not. This gave a basis of which schools to consult during this project.

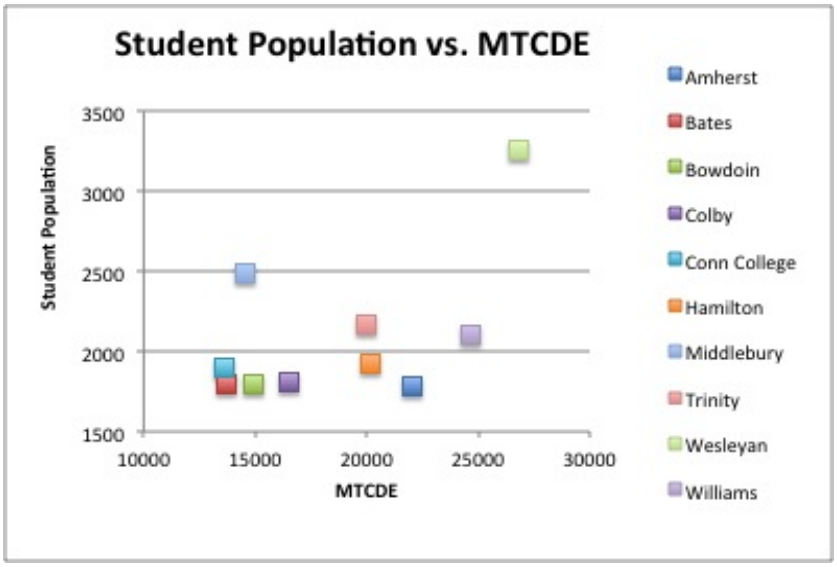


Figure 3

This figure is taken from Colby College's Climate Action plan and is a project of what would happen to their emissions if they continued "business as usual". It also shows the huge impacts of a biomass boiler, the same system Bates College wants to implement, and how they obtained climate neutrality (Colby Climate Action Plan 2010).

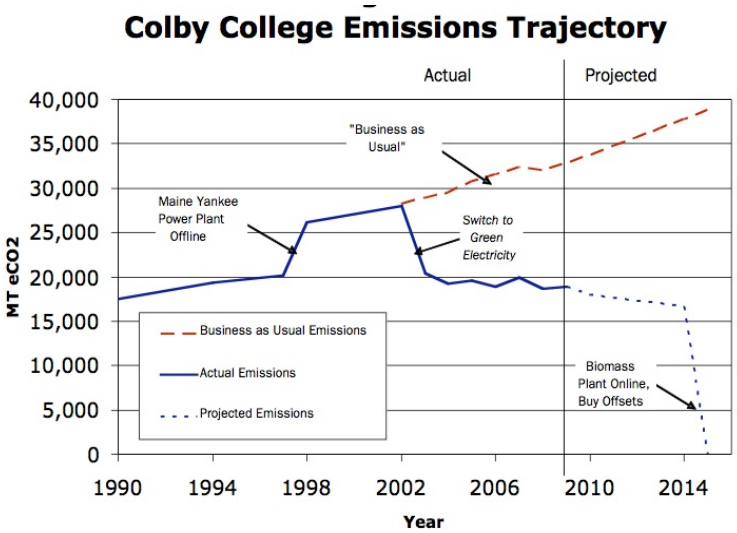


Figure 4

A comparison of the NEPOOL REC market by month of all of the New England States. Due to Maine's excessive production of hydropower, the cost is much less than all the other New England states making it an attractive option (NEPOOL GIS).

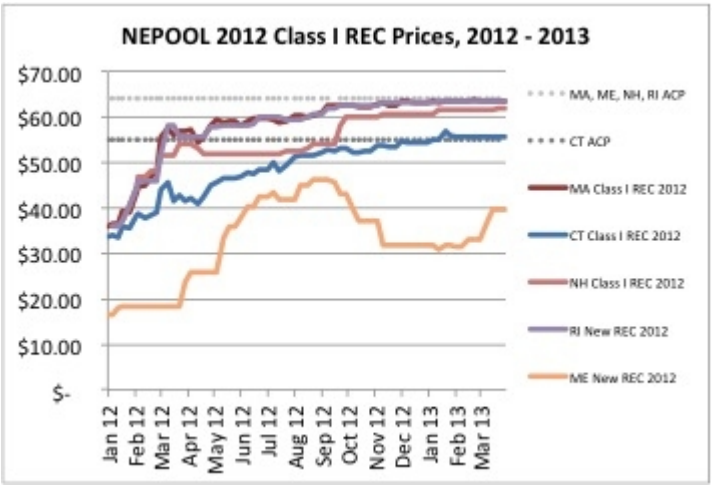
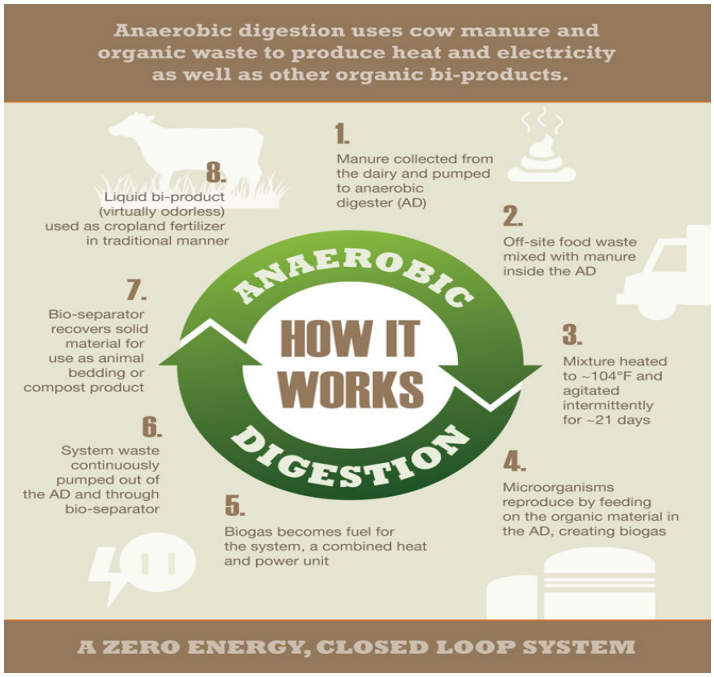


Figure 5

This brochure from Exeter Agri-Energy in Exeter, Maine shows how the anaerobic digestion system is a closed loop system. From step 1 to step 8 there is zero energy lost because the bio-separator recovers the leftover waste that works well as fertilizer and animal bedding (EAE - Exeter Agri Energy).



Introduction

Definition of Carbon Offsets and RECs

When attempting to mitigate greenhouse gas (GHG) emissions along a path towards climate neutrality (net zero emissions), various institutions are often unable to reduce all carbon dioxide emissions. There will always be some level of unavoidable emissions that will create a carbon footprint. When every measure of emissions reduction has been taken, and there is still carbon dioxide being released into the atmosphere it is time to introduce the notion of a carbon offset. According to *Carbon Offset Research & Education*, a website dedicated to analyzing offset programs, carbon offsets are simply "a tool to compensate for emissions" (CORE 2011). Carbon offsets are measured in tonnes carbon dioxide sequestered or captured. These offsets are bought and traded by institutions that recognize the decision of one party to forgo reducing their own emissions and in turn pay a second party to reduce GHG emissions for them.

It is important to distinguish the differences and to understand the similarities of carbon offsets and renewable energy credits, or RECs. Essentially RECs are a form of carbon offset but carbon offsets are not necessarily RECs. One Class I REC is equal to 1 megawatt-hour of carbon free electric power produced without any carbon emissions (EPA 2014).

Similar to a carbon offset, RECs are bought and sold in global markets. Once obtained, RECs serve as a "green tag" for electricity, that is to say an institution can claim non-renewable energy as carbon free, as long as there are enough kilowatt hours of purchased renewable energy credit to compensate for the electric power used.

The final important piece of the definition of offsets and RECs is the notion of additionality. As defined by CORE, additionality addresses the fundamental question of: "would the emissions reductions have occurred if the activity were not implemented as an offset project?" or more simply, are the invested carbon offset monies essential to the continuation of the program (CORE 2011). Additionality is an important factor, as the concept marries a user and producer financially into mutually reducing carbon emissions, in the verification process of carbon offset programs and RECs. Either form of offset is deemed invalid if they do not meet proof of additionality.

Carbon Markets: Compliance and Voluntary

There are two main global carbon offset markets. The first is the Clean Development Mechanism, or CDM, which was established by the Kyoto Protocol. The CDM was established in 1997, and is overseen by The United Nations Framework Convention on Climate Change or UNFCCC (Lovell 2010, 354). CDM enables projects to control emissions by creating tradable Certified Emissions Reductions units. Many legal rules and documents administered by the CDM Executive Board play into the registration for the buying and selling of each CDM brought into the offset market, which can make the process of trading difficult. In addition, governance of the CDM rules are carried out by corporations and non-governmental organizations (NGOs). The CDM has "mechanisms to define credit strictly and establish standards of quality through project methodologies" (Lovell, 2010, 354). Thus, the length of time for a CDM to finally be issued can take over 500 days because of the strict regulations involved in their verification.

The second main global carbon offset market is voluntary. These offsets are generally referred to as voluntary carbon offsets (VCOs) or verified emission reductions (VERs). The only difference is that VERs have been verified and "signed off by an auditor" (Lovell 2010, 354). The voluntary carbon offset market is an informal market "governed by a mix of non-governmental and private-sector organizations" and carries less universal standards compared to the CDM (Lovell 2010, 353). It is a vastly more diverse and flexible market than the CDM. For example, the voluntary offset market has no single definition for credits and "several competing standards which set criteria for how voluntary offset projects [are] set up and managed" (Lovell 2010, 354).

The VERs and VCOs programs began in the mid to late 1990s and were established to focus on forestry offsets, such as "Climate Care and The Carbon Neutral Company" (Lovell 2010, 357). However, by 2005, the voluntary offset market experienced a huge increase in companies and NGOs that create and sell carbon credits by the hundreds. The dramatic increase in the voluntary offset market can be attributed to a number of factors. One of which is the increasingly stricter criteria being set out for the compliance market, moving programs rejected from this market to the voluntary market. An additional factor being the belief that voluntary offsets likely "will be converted in time into compliance offsets" because of anticipated climate change regulations (Lovell 2010, 357).

Carbon Offset in Relation to Climate Neutrality

The carbon offset market has provided institutions with an emerging mechanism to obtain net zero carbon emissions without sacrificing internal reductions that are currently to costly or impact productivity and other efficiencies. The idea of "competitive advantage" has brought carbon offsets to the forefront of the green movement (Bumpus & Liverman 2008, 37). The growing status of environmentalism has fostered a competition among institutions to achieve a "green" public image as they strive for carbon neutrality.

The concept of carbon neutrality emerged in the late 1960s from research concerning climate change. However, the concept did not gain much traction until a decade ago, when environmental degradation was brought into the spotlight of the political agenda. Furthermore, in recent years the idea of carbon neutrality has gained much attention among large companies that want to cure their negative image of carelessly emitting large quantities of greenhouse gases (also made mandatory by the Kyoto Protocol). As a result, the emergence of carbon offset programs has fostered an industry for carbon trading. In 2006, the New Oxford American Dictionary's word of the year was "carbon neutral", one measure of the growing popularity for environmental awareness (Main 2007).

Naturally, as the demand for carbon trading markets has grown, so has an industry of carbon offset providers. These providers, or entrepreneurial ventures, "facilitate the trading of carbon credits between private entities and publicly traded organizations" who are interested in buying or selling carbon offsets in order to move toward net zero emissions (Dhanda & Murphy 2011, 37).

Critiques of Carbon Offset Programs

While carbon trading with the goal of becoming carbon neutral exhibits forward progress in the green movement, it is important that the meaning of carbon neutrality does not become lost. Carbon offsets and renewable energy credits (RECs) can be positive tools for

institutions to become deservingly carbon neutral, but the self-reporting nature of these markets can be taken advantage of.

> The system is set up in such a way that it can act as justification for creating emissions. Instead of encouraging individuals and institutions to profoundly change consumption patterns as well as social, economic and political structures, we are being asked to believe that paying a little extra for certain goods and services is sufficient. For example, if one is willing to pay a bit more for 'offset petrol' one doesn't have to worry about how much is consumed, because the price automatically includes offsetting the emissions it produces (Smith 2007, 6).

As Smith outlines above, if used incorrectly, offset programs can be a crutch to sustain bad energy practices or counterproductive if not utilized in the correct way.

Some institutions are able to recognize this and have taken drastic actions to reduce their carbon emissions instead of just offsetting them. For example, in 2009, Nike "stopped purchasing carbon offsets to counter emissions generated by employee air travel and that it was moving away from buying renewable energy certificates to compensate for use of fossil-fuel generated electricity at its own facilities" (Vestel 2010). The company decided that carbon offset programs were actually hindering their ability to maximize efficiency in product production as well as encourage them to not reduce their emissions.

Nike has since redistributed the funds it had previously used for carbon offsets and RECs and has "improve[d] energy efficiency at manufacturing facilities and reduced carbon emissions by 6 percent, even though production at the factories increased by 9 percent" (Vestel 2010). However, not all businesses have taken an initiative like Nike.

The US airline industry tried using voluntary offsets as a form of emission reduction by putting the initiative on the consumers. They believed that

> The carbon offset [had] become this magic pill, a kind of get-out-of-jail-free card," Justin Francis, the managing director of Responsible Travel, one of the world's largest green travel companies to embrace environmental sustainability, said in an interview. "It's seductive to the consumer who says, 'It's $4 and I'm carbon-neutral, so I can fly all I want'" (Rosenthal 2009).

The premium reinvested by the airlines in carbon offset programs, theoretically allowing the passenger to fly with net zero emissions, did little to actually reduce emissions.

An abuse example is Chevron Texaco's operations in Ecuador in 2003. Because Chevron Texaco had bought offsets and thus "reduced" its overall emissions "it distract[ed] from efforts to highlight the environmental injustice inherent in the fossil fuel industry… [and] bring the attention of the world to the plight of the indigenous populations of Ecuador" (Smith 2007, 48). Not only are the carbon offsets enabling the continued use of fossil fuels; they glossed over the environmental costs of terrible practices of the extraction of fossil fuels. Again, carbon offsets and RECs had facilitated the justification for much worse environmental behaviors.

Despite all the evidence against the use of carbon offsets and RECs, they can still be used as an effective means to become carbon neutral. As Nike demonstrated, money can be invested in order to reduce carbon emissions of an institution and increase production. An institution should first and foremost pursue climate neutrality without the use of carbon offsets

or RECs, like Nike, but if that is not possible at the time, investing money in a meaningful carbon offset or REC program is an important tool in the transition to neutrality (Smith 2007, 62).

Climate Neutrality on College Campuses

Beginning in the early 2000s many institutions have signed the American College and University Presidents' Climate Commitment or ACUPCC. Now signed by more than 600 of the country's most prestigious colleges and universities, pledges to "initiate the development of a comprehensive plan to achieve climate neutrality as soon as possible" (ACUPCC 2007). And subsequently has led to the independent formation of many institution specific Climate Action Plans, all making the "commitment to become carbon-neutral" (Bowdoin College, Climate Action Plan) (Figure 2). This is a paradigm shift from past practices as, "it is the people coming out of the world's best colleges and universities that are leading us down the current unhealthy, inequitable, and unsustainable path" (Cortese 2003, 16).

Climate action plans incorporate many options for reducing greenhouse gas emissions on campuses: electric power conservation, education programs, and the introduction of renewable energy practices. Some institutions, like Unity College, have "unanimously voted to divest the college endowment from fossil fuels" (Unity College 2012). While this is not a feasible option for all, other colleges have decided to invest in renewable energy credits and carbon offsets to achieve net zero carbon emissions. Bates College has pledged to invest in RECs and offsets that are local, additional, collaborative, and educational. The school currently invests in Green E certified NewWind Energy. These RECs offset Bates College's 13 million kilowatt-hours of annual electric power usage (Bates Climate Action Plan 2014).

Focusing on collaboration within educational components is key in designing a sustainable future (Cortese 2003, 16). In doing so, offset programs need to avoid the pitfalls previously discussed earlier and "have to be quantifiable, meaning they measurably reduce emissions; they have to be permanent, meaning the greenhouse gases they keep out of the atmosphere won't be released later; and they have to be real, meaning they can be verified by third-party inspectors" (Schmidt 2009). This is the key to the idea of additionality, an offset project that differentiates the reduction of emissions from "business-as-usual" (Bumpus and Liverman 2008, 37; Michaelowa 2005).

After taking the necessary steps to reduce carbon emissions by approximately 10,000 MTCDE, by installing a biomass boiler and cogeneration turbine, Bates College plans on offsetting 3,415 MTCDE through purchasing carbon offsets and RECs (Bates Climate Action Plan 2014) (Table 2 & Figure 3).

The focus of this project is to investigate the carbon offset and REC market and select programs that have distinct benefits to the greater Bates community and avoid the disincentives, abuses or whitewash issues that are presented above. The offsets that the college will invest in must be *meaningful*. Programs will be defined as *meaningful* if they are local projects that offer measurable and irreversible impacts and include opportunities for education within the Bates community.

Methods

Research

Julie Rosenbach, our community partner, first tasked us with providing her with what she called a "lay of the land" of the carbon market. She wanted us to collect background information on what the REC and carbon offset markets consist of; who is selling, who is buying, what are the prices, and what options are available. We conducted research by reading journal articles about the Kyoto Protocol, the voluntary and compliance carbon markets, environmental sustainability in higher education, and the critiques of carbon offsets.

Other methods of conducting research came in the form of interviews and conversations with members of the community and with people we could get in touch with who have experience working in the carbon market. Unfortunately, some of our requests to ask questions or perform interviews were not returned, and as a result we ended up with fewer interviews than initially intended. The people who were willing to have conversations with us included: John Rasmussen from Bates Facility Services, Peter Knights from Icon Alliances, and Greg Williams from Exeter Agri-Energy. We compiled all of our researched background information into a literature review and it has guided our work since.

Recommendations

Our second deliverable for this project was to make a few educated recommendations for Julie Rosenbach, of possible REC/offset programs for Bates College to investigate further. Julie wanted programs that would be more meaningful to invest in than the college's current renewable energy credits. In order to do this we first developed a criteria for how we would define meaningful. We formed our criteria through an ongoing conversation with Julie, and concluded that a meaningful carbon offset must be **local**, **permanent**, and **cost effective**, while forming **closed loop systems**, providing **secondary economic benefits**, and **educational opportunities**, and most importantly **additional**. From this criteria we began to research what other colleges who have gone climate neutral have done (Colby College, Middlebury College), and we looked at institutions that had implemented offset programs (Brown University, Yale University). Additionally, we narrowed our scope from nationwide REC providers, to REC providers in the state of Maine.

Results and Discussion

Our five recommendations for the Committee on Environmental Responsibility are based on our criteria of meaningful RECs and carbon offset programs (Table 3). Although there are many programs that fall under our definition of meaningful, we think that the following best match our criteria. The first three options are uniquely Maine based programs. The fourth encompasses a less expensive, more regional approach. The final recommendation is a student engagement program that we believe compliments the Bates Climate Action Plan as it is an educational device as well as a way for offsetting Bates' carbon emissions, and quite importantly, benefits local neighborhoods in Lewiston.

Maine Exeter Agri-Energy

Maine Exeter Agri-Energy (EAE) is a company that converts animal and food waste, some or which comes from Bates College's Dining Hall, into electric power. The company sells

Class I RECs from electricity generated by their anaerobic digestion system. The system uses cow manure and off-farm organic waste to produce biogas, a combustion of methane and carbon dioxide. Biogas is then used to generate renewable electricity as well as sequestering any carbon produced from the reaction (Figure 5). The byproducts of the reaction are organic fertilizer, organic soil additives, and healthy animal bedding that can be used on Stonyvale Farm. EAE plans to expand its operation in order to use to use the compressed natural gas produced during the reaction to power all of their tractors and vehicle theoretically creating a net zero farm operation.

EAE's anaerobic digestion system is a closed loop system that takes a Bates waste product and turns it into electric power that Bates could potentially purchase. It is an innovative, new, small scale operation that could possibly be open to more widespread student participation and education through survey level class field trips, upper level chemistry and biology classes, or even the subject of future senior theses. The RECs from EAE are moderately priced at 2-3¢/kWh. However, it is not a large enough operation to supply all of the electricity demanded by Bates on an annual basis (EAE produces 7,500,000 kWh/year). It is located on Stonyvale Farms in Exeter, Maine, a drive of less than 100 miles from the Bates College campus (Williams 2014).

Maine Tidal Energy Project

Maine Tidal Energy is a project based in Eastport, Maine that has recently begun generating electric power by using the massive tidal changes in the Bay of Fundy. Tidal energy is an extremely regionally restricted energy resource that can only be implemented in specific parts of the world. The project in Eastport is currently quite small, only generating enough electricity to power over 2000 homes (about 5 megawatts).

The reason for its endorsement is that the only other place that it is used to this effect in the United States is Alaska. Maine Tidal Power is connected to the Maine electric grid and therefore would be used by Bates College. It is a very unique program that is continuing to grow and expand. However, price is a concern as it is a very expensive option at 12.5¢/kWh. But the opportunity to support an innovative, uniquely Maine project might be appealing as a way to educate the student body on the vast number of ways that electric power can be generated without a carbon footprint.

Maine Green Power Program

The Maine Green Power Program is a REC provider that only sells RECs produced in Maine. The Maine Public Utilities Commission oversees a selection of renewable energy and ensures that only Maine renewable resources are used. This program helps build demand for more renewable energy sources in Maine, and subsequently creates jobs. Additionally, Maine Green Power uses a portion of its funding to educate the local community. The only concern we would raise, is that it is unclear which kind of renewable energy is being invested in, and does not seem to include some of the more innovative Maine based efforts (see above). But considering the information discussed earlier from the U.S. Energy Information Administration website, it is most likely electric power generated by biomass (an important Maine industry) or hydroelectric sources. It is also a relatively inexpensive REC at 1.5¢/kWh and residents and businesses can tailor the amount of purchased in the form of 500 kilowatt hour "blocks." Each

"block" is $7.50 per month and prices for commercial customers start at $7.50 per 500 kilowatt-hour block, and are customized to meet business needs and usage levels.

NEPOOL Class I RECs

NEPOOL is a relatively standard REC programs that is located throughout New England. NEPOOL supplies Green E certified hydroelectric power to its customers for 2-4¢/kWh. The price of the RECs fluctuates seasonally (Figure 4), but an arrangement could be made to accommodate the large-scale demand of Bates College (NEPOOL GIS). The reasoning for our endorsement of NEPOOL is based on the fact that the Maine electric grid receives over 32% (320 GWh) of its power from hydroelectric sources (US Energy Administration). Bates College is plugged into Maine's electric grid system. Therefore approximately 32% of Bates' electricity comes from hydroelectric sources. Not only will Bates use the electricity it pays a premium for, its investment will bolster the hydroelectric industry in Maine, and northern New England. Satisfying the criteria of local, closed loop, cost effective, and secondary economic benefits criteria of a meaningful carbon offset.

Community Engagement Program (Community Carbon Fund) - Yale University Model

Yale University has created a program which allows members of the community to donate monetary gifts to a "Community Carbon Fund". Community members are provided a "carbon calculator" that estimates carbon emissions associated with various activities on campus: faculty travel, community events, travel for sports teams, etc. The calculator values those emissions, and suggests a monetary value for a donation (Yale Sustainability 2014). The Community Carbon Fund is used to spearhead energy efficiency projects for local low-income housing establishments. These energy efficiency measures mitigate carbon emissions and can be claimed as carbon offset programs.

A program rooted in community and student engagement allows for ample educational opportunities for both the college and greater Lewiston Auburn area. These projects not only provide a meaningful improvement to livelihood of low-income families in the local area but they also can provide secondary economic benefit to the families by reducing their energy usage and heating bills. The Yale University model that we outlined can be thought of as a platform for community engagement projects, and has the potential to be molded into a variety of potential offset programs.

Criteria

In 2020, after the successful installation of a biomass boiler and cogeneration turbine system, Bates College will need to offset 3415 MTCDEs through carbon offsets and buy RECs for 13 x 10^6 kWh of electricity (Bates Climate Action Plan 2014) (Table 2). Bates currently invests in a Green E certified wind energy project in Iowa to offset its annual electric power usage. These RECs were a class gift and the contract expires in two years. With the contract with NewWind ending, Bates College has been given the opportunity to rework its long term strategy to obtain carbon neutrality.

Our project, as advised by our community partner Julie Rosenbach, asked us to advise Bates College on which meaningful carbon offset programs to invest in. With the information gathered from our research and through interviews with individuals from the entire spectrum of

the field, we believe that there are four primary aspects of a meaningful carbon offset project. They are as follows:

1. **Locality**
    a. **Permanence**
    b. **Closed Loop Systems**
    c. **Secondary Economic Benefits**
2. **Cost Effectiveness**
3. **Educational Component**
4. **Additionality**

Locality

If electric power is produced or carbon dioxide is sequestered too distant from our community, the benefits of Bates College's investments become too abstract. By investing in more local projects, the college would be using the electrical power it is paying for, therefore allowing the local community to feel the benefits of carbon neutrality.

For example, approximately 32% of Maine's electricity is produced by hydroelectric sources and 25-30% from biomass (U.S. Energy Information Administration). This means that there is greater than a 50% chance that the electrical power that is used to light the Bates College Dining Hall is from either biomass or hydroelectric plants and it is advantageous for Bates College to consider REC programs that utilize one of these two sources of power generation. We have further weighted locality to be a meaningful offset program with three subcomponents: permanence, closed-loop nature of the program, and potential secondary economic benefits. We believe that these three ideas play naturally into the definition of the locality and each should be considered independently.

a. Permanence

A meaningful offset is not a temporary solution. It must have measurable and non-reversible impact; and have a high degree of predictability. The offset must have financial meaning to the institution. For this report, permanence is an essential attribute if Bates College is to consider the options of carbon offsets and RECs themselves. Ideally there would continuous investment and continuous return on investment to move beyond carbon neutrality.

An example of the importance of the permanence concept, arguably close to the State of Maine, are carbon offset projects that rely heavily on the conservation of forests or woodlands as well as projects that promote the planting of trees around the globe. These forestation efforts are not projects that Bates College should to pursue, they do not meet permanence. The reasons for this are two-fold.

First, a forest is a piece of nature that easily could be destroyed through natural unavoidable causes such as fire, severe weather, or insect infestation. These risks of destruction fail: predictability, non-reversible, and financial return criteria. Secondly, say for example, that the college invested in planting enough trees to offset all of their carbon dioxide emissions for one year after the installation of the new biomass boiler (3415 MTCDE (Table 2)). In order to sequester enough carbon dioxide to offset that much carbon they would need to plant thousands of trees. According to a study from Tufts University, Bates College would need to plant over 1330 birch/maple/beech trees that are 25 years old to offset the amount of carbon produced in

one year (Carbon Sequestration). The college's initial investment would be enormous and the natural replacement of dead trees would be an added financial burden. In essence Bates College would be investing in a high cost-short term commodity that likely would compromise financial resources for education.

b. Closed Loop Systems

The idea of utilizing a closed loop system is that the power paid for is the power used. The ideal closed loop system features a direct action-reaction relationship between Bates College and the carbon offset program; as an example taking a Bates College waste product, sending it off to a reutilization program, and being able to claim a carbon offset in return.

The issue of creating a closed loop system was discussed at length in an interview with Peter Knights, a developer in the Connecticut River Valley in New Hampshire and Vermont. Mr. Knights has gone to great lengths in recent years to make his developments LEED certified and carbon neutral. He discussed several strategies on how he accomplishes this. One such strategy comes from his greater understanding of the electric power grid in his region. Mr. Knights identified Quebec Hydro, a hydroelectric power plant that supplies power into the Eastern Interconnection grid, as the chief supplier of electric power to his region. He argues that, when he is considering RECs, Green E certified hydropower is by far his strongest option. In fact, Mr. Knights is adamant that his projects not invest in wind or solar RECs because the likelihood of his development actually using the generated power is slim to none. Therefore he heavily promotes the use of hydroelectric power due to his close proximity to numerous hydroelectric plants on the Connecticut River.

The college currently invests in Green E certified wind RECs from Iowa. While this investment is better than nothing, this is far from ideal from a closed loop perspective. The idea of a closed loop implies that Bates gives a commodity and receives a different commodity in exchange, in this case carbon offsets or RECs. Smaller examples of closed loop efforts already exist on campus, and are very prevalent in the Bates College Dining Hall. Food waste is sent to the pig farm from whom the college buys its pork products. Additionally Bates College sends old cooking oils to Exeter Agri-Energy in Exeter, Maine (Williams 2014). The old cooking oil is then turned into electricity that the college could potentially buy. Exeter Agri-Energy is one example of a potentially meaningful closed looped system that Bates College could invest in for the long term.

c. Secondary Economic Benefits

Bates College is part of the greater Lewiston-Auburn area, and the students at the college are encouraged to pursue opportunities that introduce them into the local community. The notion of secondary economic benefits refers to the school's investments positively impacting both the college and its community. If given the opportunity, Bates College should strive to invest in Maine wind power instead of Iowa wind power, as the money invested promotes the growth of the industry in Maine and stimulates the local economy.

Many small-scale offset programs consider the notion of improving local energy efficiency measures. This could entail analyzing household appliances such as washers, dryers, dishwashers and showerheads in buildings in the Lewiston-Auburn community, and providing items that minimize energy and electricity consumption. Items such as low-flow showerheads compact fluorescent light bulbs and self-moderating thermostats are examples of ways to lower

power consumption. A community based project like this would foster a positive relationship with the local community and have a meaningful impact on the greater Bates community.

Furthermore, if money is invested in local RECs then their programs will grow and may even surpass their less meaningful competition. Exeter Agri-Energy, a local farm that is changing the way we think about composting, generates renewable energy from food and animal waste. The organic waste, some of which is from Bates College, is processed in large anaerobic digesters. The product is an energy-packed biogas, a mix of GHGs that would normally be emitted into the atmosphere. The biogas product is burned and powers a generator that provides enough heat energy to replace 700 gallons of heating oil, and 22,000 kWh of electricity daily (EAE, 2014). This energy production is the equivalent of heating 300 houses and powering 800 homes all while producing no carbon emissions. Programs like this exist in Maine, and by endorsing them Bates College would spearhead a network of local institutions at the forefront of climate neutrality, and far more predictable than a forestry effort.

Cost Effective

Cost is always going to be a driving factor for any green initiative. While Bates College has expressed a desire to have better carbon offset programs, cost is still a driving factor. This whole report revolves around the assumption that Bates College will decide to invest millions of dollars to install a biomass boiler and cogeneration turbine in its power plant in order to reduce its carbon footprint (Table 2). Once that occurs, further investment will be needed to actually achieve carbon neutrality.

RECs can range anywhere from less than 0.5¢ to 13¢/kWh (Berry 2002). However, how do you put a monetary value on the meaningfulness of a carbon offset or REC? The simple answer is that an institution needs to create its own definitions, and honestly assess its return on investment. Our report offers some quantifiable criteria. Furthermore, there is no evidence that the best offsets are achieved through a single program. In fact multiple smaller investments may add flexibility. Considering the location of Bates College and its financial role, in Maine, a state that prides itself on its small businesses and rural lifestyle, it is fitting for the college to consider supporting many smaller projects. While there is still no monetary value placed on meaningfulness, the intangibles provide the opportunity for even more benefits to the college and Bates community as a whole.

Educational Component/Student Participation

The most difficult challenge in developing a meaningful offset program is finding educational value. Although the student body may not be able to participate in all of Bates' offset programs, like the purchasing of RECs, they can still learn from these programs. Bates College's willingness to invest in RECs and offsets suggests its desire to build a sustainable community. By exploring carbon-offset programs close to campus, like Exeter Agri-Energy, opportunities are created for students to interact with and learn from experts in a field.

Additionality

Additionality has been discussed at length throughout this report and the general concept remains the same. A carbon-offset program is not a legitimate, verifiable program unless it has an aspect of additionality. However, Bates College should invest in projects that are

meaningfully additional. This means that offset programs need to be additional for all parties involved. By definition a carbon offset program is additional if it cannot function without the incoming monies from carbon trading. If all of the criteria above are met, then Bates College should not be able to function without its carbon offset programs.

Outcomes

The results from this study reveal that the voluntary market for carbon offsets and renewable energy credits is very unregulated. Individuals, companies, and institutions can easily access this market and have the ability to put money into any offset program they want and claim reduced emissions. However, finding a program that meets the specific needs of an institution can prove difficult. Developing a sense of what is meaningful to the investor is an important additional part of the purchasing process. The RECs and offset programs that we have highlighted in this report align with the criteria we stressed to define as meaningful. Most importantly, we believe our definition of meaningful meshes with the goals of Bates College.

Our definition of *meaningful* is made up of seven components: locality, permanence, closed loop systems, secondary economic benefits, additionality, cost effectiveness, and educational potential. Using these criteria as screens we researched REC and offset programs, and made our recommendations to the college. Of our recommendations, the majority are classified as RECs, in-part because there is a creative component to the instigation of carbon reduction projects.

Hopefully this project also provides Bates College with a better understanding of the carbon market. And reinforces the notion that at times the wild-west style of the market can lead to less than meaningful investments. The argument can be made that it is better to follow in the footsteps of an institution like Unity College, who has chosen not to invest in offsets and instead divest from fossil fuels. However, defining and adhering to institutional meaningful criteria offers all the potential and opportunities for innovative investment within the carbon offset market, and greater impact for achieving carbon reduction.

Implications

The way in which carbon offsets and RECs are used in the future at Bates College will depend on how the college plans to reduce total carbon emission levels in the years to come. If the college first invests in a biomass boiler and cogeneration turbine to replace the #2 oil and natural gas boilers that are currently used, the college will be able to reduce up to 40% of current emission levels (Bates Climate Action Plan). After mitigating these carbon emissions on campus, the college will still need to offset a smaller emissions burden, hopefully allowing for easily implemented small-scale and local solutions. These local opportunities could allow for student engagement and education, and promote a campus culture where greenhouse gas reduction initiatives are respected and valued.

This process may not be a quick. Changes in the current schema of offsetting programs will only come with a positive student response. The continued education of the student body on the importance of climate change awareness and processes to mitigate carbon dioxide emissions are important building blocks to the implementation of more meaningful carbon offset programs and REC investments.

Next Steps

This project studied current carbon markets, and renewable energy resources available to consumers of a broad scale. The information that we gathered will be one basis to advise future decisions about what will be included in revisions to the current climate action plan. The Office of Sustainability will also continue to use our detailed definition of meaningful, as they continue to search for carbon offset and REC programs.

In future capstone classes we feel it would be worthwhile to investigate further the current system for waste disposal at the college. Our research included an investigation of a landfill gas pipeline that currently supplies the University of New Hampshire with a renewable, carbon-neutral biogas to use as their primary energy source (Cogeneration and Ecoline). The waste-to-energy algorithm is quite appealing, and further research found that waste from twelve municipalities in the area surrounding Bates College are already being taken to the Mid-Maine Waste Action Corporation, a waste-to-energy landfill and cogeneration plant. It is not clear how Bates College participates, if at all, but it is clear this study is just a preliminary step and hopefully opened some door for further investigation for innovative carbon reduction.

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Appendices

IRB Proposal and Consent Form

Nicholas Ford, Felix Xie, and H. Fuller Henriques IV.
October 30th, 2014
Project: Developing Meaningful Carbon Offsets for Bates College

Overview:

The carbon offset market has gained a considerable amount of attention in recent years. The emergence of carbon offsets and renewable energy certificates (RECs) can be attributed to the growing concern for the environment and climate change. As a result, many institutions, companies, and individuals have begun offsetting their carbon footprints, and in some cases strive to attain carbon neutrality, or zero carbon footprint. Carbon offsets and RECs are easy and effective ways to offset carbon footprints. However, since carbon offsets and RECs are fairly new, regulations and restrictions on them remain ambiguous and debatable. Although, Bates College is already invested in a few carbon offsets, it is working on finding new and meaningful carbon offsets, eventually aiming to become carbon neutral by 2020.

As this field is relatively unregulated and almost haphazard, gathering information from a wide array of sources is imperative. Some of the most helpful resources are people who directly deal with carbon offsets and RECs and their opinions, ideas, and insight are essential to the completion of a thorough investigation of the carbon offset and REC market as it applies to Bates.

There will be approximately 10 interviews, in which the interviewee will be asked a series of questions for the purpose of collecting background information about the carbon market. Each in person interview will last approximately 30 minutes to an hour. These interviews will be part of a final report that will be presented to the Office of Sustainability Committee on Environmental Responsibility in addition to a presentation at the bi-weekly Bates EnviroLunch Series held in New Commons. The final report will also be uploaded to the Bates College website, where it will become accessible to the public.

In our final report, we will summarize the carbon offset and RECs market, and provide Office of Sustainability Committee on Environmental Responsibility with carbon offset and REC recommendations for its goal to become climate neutral by 2020, which is stated in the Bates Climate Action Plan 2014. Our recommendations for investing in carbon offsets and RECs will be based on our developed criteria of meaningful offsets. Part of the criteria for meaningful offsets include permanence, additionality, cost effectiveness, secondary economic benefits, and locality of offset.

Procedure:

The interviewer will give the interviewee the consent form either verbally, if the interview is being conducted over the phone, or physically, if it is an in person interview. After the consent form has been given in full and agreed to, the interview shall commence. If the interview happens in person, or over the phone, notes will be taken throughout the interview. If the interview cannot be conducted in real-time, we will send the interviewee a series of questions via email. The responses to their questions will then become a part of our research, and the emails will be deleted once the project has concluded.

Consent Form

I, _____ , have read the attached proposal describing a study being conducted by a group of students in the Community-Engaged Research class, Department of Environmental Studies, Bates College, Lewiston, Maine conducted by Nicholas Ford, Felix Xie, and H. Fuller Henriques IV.

I hereby consent to participation in this study.

I understand that my participation in this study is voluntary and that the information I give will be used only to further the education of those conducting the research. I understand that I may stop the interview at any time and may choose to not answer a question if I feel that the information is confidential. I understand that the information I give will not be connected to my name unless I grant permission below, and that the information I give may be used in the final report. I understand that the interview, 30-60 minutes, will not be audio recorded, nor will it be transcribed. However, I understand that notes will be taken during the interview. The notes taken will be destroyed at the culmination of the semester.

I agree that the information I give will be used in a final report that will be presented to both the Office of Sustainability Committee on Environmental Responsibility and at the bi-weekly Bates EnviroLunch Series held in New Commons in December. I understand that the final report will also be uploaded to the Bates College website, where it will become accessible to the public.

_____ _____

Signature Date

Yes, I agree that my name, position, and organization can be used in conjunction with the information I give during this interview.

_____ _____

Signature Date

Current RECs at Bates College

Constellation Energy

Green-e Energy CERTIFIED

Constellation Energy

is pleased to recognize

Bates College The President and Trustees of

for matching

100%

of electricity usage with

Renewable Energy Certificates

Contract Dates	Fuel Type
Dec 2012 - Dec 2016	NewMix Wind

05/04/2012

Michael P. Kagan - Chief Retail Sales Officer — Date

Going green with Constellation

Constellation Energy

Green-e Energy CERTIFIED

Constellation Energy

is pleased to recognize

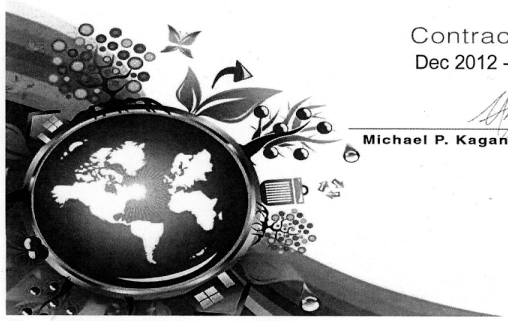
Bates College The President and Trustees of

for matching

100%

of electricity usage with

Renewable Energy Certificates



Contract Dates	Fuel Type
Dec 2012 - Dec 2016	NewMix Wind

04/26/2012

Michael P. Kagan - Chief Retail Sales Officer — Date

Going green with Constellation

HISTORICAL PRODUCT CONTENT LABEL 2013

Constellation NewEnergy®
Green-e Energy Certified Renewable Energy Certificates

Bates College, The President and Trustees of

Contract # 1-1687465331

This is a renewable energy certificate (REC) product. For every unit of renewable electricity generated, an equivalent amount of RECs is produced. The purchase of RECs supports renewable electricity generation, which helps reduce conventional electricity generation in the region where the renewable generator is located.

This product matches 100% of the electricity usage at the contracted accounts in 2013

This product is made up of the following mix of New Renewable Resources

Green-e Energy Certified New[1] Renewables in NewMix[SM] Product		Generation Location[2]
Biomass	0%	
Geothermal	0%	
Eligible Hydroelectric[3]	0%	
Solar	0%	
Wind	100%	2013 Mix
Total[4]	**100%**	

1. New Renewables come from generation facilities that first began commercial operation on or after January 1, 1999.

2. 2013 Mix is the regional mix of Constellation's portfolio of RECs procured for 2013, and comes from 4 NERC Regions - MRO (Midwest Reliability Organization), SPP (Southwest Power Pool), RFC (Reliability First Corporation), and SERC (Southeast Reliability Corporation). This location is the actual mix of renewable resources reported to the Green-e Energy program in Constellation's annual verification audit for 2013. The state level breakdown of RECs supplied to you is: 46% IA, 28% OK, 8% IL, 8% MN, 4% ND, 3% IN, 2% MO, and 1% SD.

3. Eligible hydroelectric facilities are defined in the Green-e Energy National Standard (http://www.green-e.org/getcert_re_stan.shtml) and include facilities certified by the Low Impact Hydropower Institute (LIHI) (www.lowimpacthydro.org); facilities that are run-of-the-river hydropower facilities with a total rated nameplate capacity equal to or less than 5 MW; and facilities comprised of a turbine in a pipeline or a turbine in an irrigation canal.

4. For comparison, the current average mix of fuel sources supplying the US electricity grid is: Coal (44%), Nuclear (20%), Oil (1%), Natural Gas (23%), Large Hydroelectric (6%), Other Fossil Fuels (1%), and Renewables (5%). (eGRID2012 v1.0)

5. These figures reflect the RECs that we have contracted to provide based on actual electricity usage and the actual mix of renewable resources supplied in 2013.

For specific information about this electricity product, please contact Constellation NewEnergy, Inc., 866-237-7693,or www.constellation.com.

Green-e Energy certifies that NewMix[SM] Wind meets the minimum environmental and consumer protection standards established by the non-profit Center for Resource Solutions. For more information on Green-e Energy certification requirements, call 1-888-63-GREEN or logon to www.green-e.org.

Green-e Energy CERTIFIED

Quantity of Renewable Energy Certificates[5]

Purchasing Mechanism:	Green Percentage	Electricity Usage (KWh)	Electricity Usage (MWh)	Portion of Usage Matched with RECs	REC Quantity
Load Following	100%	13,709,200	13,709	13,709	13,709

Renewable Energy Certificates Details

REC Source Location	2013 Mix	EPA eGRID CO_2 Output Emission Rate (lb/MWh)	EPA eGRID CO_2 Output Emission Rate (MT/MWh)
		1,915.02	0.87

Renewable Energy Certificate Carbon Equivalents[6]

Conversion of REC acquisition into CO_2 equivalents:	**26,253,068.93 pounds**
	OR
	11,908.39 metric tonnes

6. REC purchases result in avoided CO2 emissions due to a reduction in indirect emissions associated with displaced generation of grid electricity. The carbon equivalent provided above is based upon most recent EPA eGRID non-baseload emission rate factors for the specified NERC Region (eGRID2012 v1.0).

Please retain this document as record of the volume of RECs supplied to you during 2013

HISTORICAL PRODUCT CONTENT LABEL 2013

Constellation NewEnergy®
Green-e Energy Certified Renewable Energy Certificates

Bates College, The President and Trustees of

Contract # 1-1702383762

This is a renewable energy certificate (REC) product. For every unit of renewable electricity generated, an equivalent amount of RECs is produced. The purchase of RECs supports renewable electricity generation, which helps reduce conventional electricity generation in the region where the renewable generator is located.

This product matches 100% of the electricity usage at the contracted accounts in 2013

This product is made up of the following mix of New Renewable Resources

Green-e Energy Certified New[1] Renewables in NewMix[SM] Product		Generation Location[2]
Biomass	0%	
Geothermal	0%	
Eligible Hydroelectric[3]	0%	
Solar	0%	
Wind	100%	2013 Mix
Total[4]	**100%**	

1. New Renewables come from generation facilities that first began commercial operation on or after January 1, 1999.

2. 2013 Mix is the regional mix of Constellation's portfolio of RECs procured for 2013, and comes from 4 NERC Regions - MRO (Midwest Reliability Organization), SPP (Southwest Power Pool), RFC (Reliability First Corporation), and SERC (Southeast Reliability Corporation). This location is the actual mix of renewable resources reported to the Green-e Energy program in Constellation's annual verification audit for 2013. The state level breakdown of RECs supplied to you is: 46% IA, 28% OK, 8% IL, 8% MN, 4% ND, 3% IN, 2% MO, and 1% SD.

3. Eligible hydroelectric facilities are defined in the Green-e Energy National Standard (http://www.green-e.org/getcert_re_stan.shtml) and include facilities certified by the Low Impact Hydropower Institute (LIHI) (www.lowimpacthydro.org); facilities that are run-of-the-river hydropower facilities with a total rated nameplate capacity equal to or less than 5 MW; and facilities comprised of a turbine in a pipeline or a turbine in an irrigation canal.

4. For comparison, the current average mix of fuel sources supplying the US electricity grid is: Coal (44%), Nuclear (20%), Oil (1%), Natural Gas (23%), Large Hydroelectric (6%), Other Fossil Fuels (1%), and Renewables (5%). (eGRID2012 v1.0)

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Green-e Energy certifies that NewMix[SM] Wind meets the minimum environmental and consumer protection standards established by the non-profit Center for Resource Solutions. For more information on Green-e Energy certification requirements, call 1-888-63-GREEN or logon to www.green-e.org.

Green-e Energy CERTIFIED

Quantity of Renewable Energy Certificates[5]

Purchasing Mechanism:	Green Percentage	Electricity Usage (KWh)	Electricity Usage (MWh)	Portion of Usage Matched with RECs	REC Quantity
Load Following	100%	672,770	673	673	673

Renewable Energy Certificates Details

REC Source Location	2013 Mix	EPA eGRID CO_2 Output Emission Rate (lb/MWh)	EPA eGRID CO_2 Output Emission Rate (MT/MWh)
		1,915.02	0.87

Renewable Energy Certificate Carbon Equivalents[6]

Conversion of REC acquisition into CO_2 equivalents:	**1,288,811.39 pounds**
	OR
	584.60 metric tonnes

6. REC purchases result in avoided CO2 emissions due to a reduction in indirect emissions associated with displaced generation of grid electricity. The carbon equivalent provided above is based upon most recent EPA eGRID non-baseload emission rate factors for the specified NERC Region (eGRID2012 v1.0).

Please retain this document as record of the volume of RECs supplied to you during 2013